A STUDY OF SLOVENIAN ARMED FORCES AMMUNITION FORECASTING METHODOLOGY

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The purpose of this research is to investigate Slovenian Armed Forces (SAF) ammunition forecasting methods and determine if the current planning method can and will be capable of supporting the future military challenges of the SAF, as part of the National Defense Forces and part of the NATO, EU, UN or other coalition led operations. Currently, nations are using two major planning methodologies Level of Effort and Target Oriented Methodology. This study describes how different countries utilize these planning methods in their ammunition forecasting. Examples are from the Canadian Armed Forces, USMC, UK, USA and Slovenian Armed Forces.

In order to examine the SAF planning ammunition forecasting methodology in support of future operations, calculations were conducted resuming data for future military involvement, in accordance with National Security Strategy and other Strategic documents. The research shows that current planning methods do not support SAF ammunition forecasting for future operations.

Guidance for future projects on a similar thesis is provided along with my recommendation to the SAF higher headquarters.

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ABSTRACT

A STUDY OF SLOVENIAN ARMED FORCES AMMUNITION FORECASTING METHODOLOGY, by Captain Robert Slak, 78 pages.

The purpose of this research is to investigate Slovenian Armed Forces (SAF) ammunition forecasting methods and determine if the current planning method can and will be capable of supporting the future military challenges of the SAF, as part of the National Defense Forces and part of the NATO, EU, UN or other coalition led operations. Currently, nations are using two major planning methodologies Level of Effort and Target Oriented Methodology. This study describes how different countries utilize these planning methods in their ammunition forecasting. Examples are from the Canadian Armed Forces, USMC, UK, USA and Slovenian Armed Forces.

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This thesis is dedicated to my children Nina, Ana Lisa, Miha, and Jaka for all the time that I was away from them.

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ACRONYMS

ACROSS	Allied Command Resource Optimization Software System
BL	Basic Load
BN	Battalion
CO	Company
DOS	Days of Supply
EU	European Union
JNA	Yugoslavian People's Army
LOE	Level of Effort
NATO	North Atlantic Treaty Organization
PSO	Peace Support Operation
RS	Republic of Slovenia
SAF	Slovenian Armed Forces
SDOS	Standard Days of Supplies
SPG	Stockpile Planning Guidance
TOM	Target Oriented Methodology
UN	United Nations
US	United States
USMC	United States Marine Corps

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CHAPTER 1

INTRODUCTION

> Logistics is traditionally an unglamorous and underappreciated activity. To generalize, when the battle is going well, the strategist and tactician are lionized; it is only when the tanks run out of gas that people go head-hunting for the logisticians.
>
> — Lieutenant General William G. Pagonis, USA (Retired),
> *Quotes for the Air Force Logistician*

Purpose

As the Slovenian Armed Forces (SAF) operational tempo increases, it is essential that planners predict through forecasting methods the appropriate amount of ammunition required at the strategic, operational, and tactical level. As a Battalion (BN) and Brigade S4, I was also constantly confronting ammunition shortages due to different methods of ammunition forecasting at different levels.

The persistence of this study is to examine SAF ammunition forecasting methodology, as we face the challenge of future military operations. More specifically, to examine SAF ammunition forecasting methods considering initial and sustainment training, operational and tactical requirements in support of future SAF in NATO and-or Coalition led operations and national defense requirements.

Background

Reducing the logistical footprint is every maneuver commander's goal. Among the North Atlantic Treaty Organization (NATO) alliance armies, there is a long tendency to unify equipment, logistical materials, classes of supply, and planning methods. There have been several attempts by NATO to organize multinational logistical units into

Multinational Integrated Logistic Units that would support all nations in a theater of operation. For a limited time, these units were operational but limited in the role of logistical operations.

In a NATO led operation, each country is required to maintain 30 days of supply (DOS) in an operational area to support their forces. In addition to this planning guidance, ammunition remains the responsibility for each nation. NATO operational consumption factors usually predict an amount of material per person, per day, with the ability to use an operational multiplier resulting in transportation requirements but do not identify the specific types or amounts of ammunition.[1] However, questions arise as to how much is actually 30 days worth of ammunition? How do different combat conditions affect DOS? Is every nation using the same forecasting methods? How do the different ammunition planning methodologies affect operational capabilities on different armies, or is there any impact at all? These are some of the questions that arise when working in a multinational environment.

When the SAF formed in 1991, the former Yugoslavian People's Army (JNA) left behind most of its military equipment. In addition to the equipment, SAF also incorporated JNA's doctrine to defend the country. The SAF leadership was comprised of ex-Yugoslav officers and enlisted personnel that stayed in Slovenia after the conflict and joined the SAF. Together these members along with Slovenian Territorial Defense Forces formed the foundation for the new military force the SAF. All the officers had taught the same JNA doctrines, which became the foundation doctrine for the SAF. In fact, students in the SAF military schools were taught from the JNA doctrine and manuals.

The JNA ammunition forecasting method was different from what the SAF is currently using. Forecasting tools based on the JNA historical data supported training programs and the Basic Load (BL) in support of doctrinal operations. The basic planning unit was the BL of the weapons systems that was usually based on the systems technical characteristics. For example, small arms BL was created on how many magazines individual soldiers carried. The BL of different weapon systems was based on the amount of available space used for ammunition storage. Operational planning grounded on simple BL depended on applying a multiplying factor that addressed the operation type, either defense or offence, with additional variants depending on high, moderate, or low intensity.

As Slovenia transitioned to a Partnership for Peace member with NATO, an increasing number of the SAF Officers and NCOs went to various NATO schools and were involved in different levels of exercises. At the same time, the United States (US) started to sponsor state programs, Military to Military, Officer Exchange Programs, Mobile Training Teams and International Military Training. A result of these programs was a change in the SAF doctrine and manuals that enabled the army to support its first United Nations (UN) mission outside of Slovenia. This was the first time that the SAF logisticians were faced with new challenges to plan ammunition for usage on an extended deployment. The BL concept was still used as the basic planning unit, multiplied by intensity factors.

In 2004, Slovenia became a full NATO member and the rearmament process was over. The SAF planning processes adopted new terms: DOS, Standard Days of Supply (SDOS), Combat Day of Supply, and five classes of supply in the system. With new

weapon systems, and planning processes, the SAF adopted new weapon qualification programs.

The current SAF ammunition planning guidance is determining strategic planning factors for ammunition forecasting in accordance with strategic reserves, ammunition usage, maintenance tracking, and operational needs in conjunction with available resources.[2] Forecasted munitions should sustain the SAF initial and sustainment training of active and reserve components, support all coalition led operations, and sustain national defense in accordance with the National Defense Strategy.

The SAF ammunition forecasting method uses NATO planning methodology Level of Effort (LOE) and Target Oriented Methodology (TOM). LOE is most commonly used for small caliber munitions and TOM for decisive munitions such as artillery, tank, rockets, and other. The strategic planning cycle is six years as the SAF Defense Program, which is synchronized, with the Resolution on General Long-Term Development and Equipping Program of the SAF and the NATO Force Goals, supported by the SAF. The SAF Defense Program designate SAF mission, development goals, national defense capabilities, and NATO led operations where the SAF will be involved.[3]

National Security Strategy of the Republic of Slovenia

Slovenian National Security Strategy vital interests are; the preservation of the independence, sovereignty, and territorial integrity of the state, and the preservation of the national identity, culture, and autonomy of the Slovenian Nation within the internationally recognized borders of the Republic of Slovenia (RS) as well as abroad and throughout the world.[4] The RS will pursue national interests through an intense and active

role in the region as well as part of the UN, the European Union, NATO and other international organizations using the instruments of the international law.

The geostrategic location of the RS is very important even in the times of globalization and transnational concepts. Across Slovenia are the shortest routes from West and Central Europe connecting Southeast Europe and Asia and the shortest route connecting Central Europe with Adriatic Sea Coast.

The RS`s main security involvement in the international security environment is in the Euro-Atlantic Region, with the key impact on securing international peace and providing security to the European Union (EU) and NATO, significant to the international environment of the RS, is the area of South Eastern Europe. The possibility of armed conflict between the countries in the Euro-Atlantic area is moderate, with the threat of asymmetric attack by non-state players rising. The national security is affected with post conflict reconstruction of the Western Balkans, which reflect the non-military threat as organized crime, arms, drugs, human trafficking, terrorists and the possibility of ethnic and religious issues. The RS participates in international operations and missions and thus contributes to international peace, security, and stability. In short and midterms, the RS is not exposed to direct military threats but changes in politics and security situations in Eastern, South-Eastern Europe (Balkans) and the Euro Atlantic area, can influence low intensity conflict.[5]

The defense policy will maintain focus on national defense, the collective defense capabilities, and fulfilling the international obligations within NATO and EU operations, with direct effect on the RS national security. Priority of missions as part of NATO and the EU in the area of South-Eastern Europe, the Middle East, Central Asia, and North

Africa. “The SAF will be capable of joint operations in multinational military context, both conventional and asymmetrical forms of combat operations. Military equipment and armament will provide the basis for the proper level of interoperability.”[6]

Strategic interest of the RS to be part of multinational operations is determined by geostrategic position, political, security, economical, humanitarian, and other interests and international agreements with different organizations. Geographical strategic interests are in South-Eastern Europe, Caucasus, the Mediterranean, the Near East, Asia, Africa, and other parts of the world. South-Eastern Europe is the region of primary interest because of political, economic, security, and others reasons, also important is a situational understanding in the region, culture, and language. The RS Ministry of Defense is the primary source of support to the international military operations; unplanned expenses are financed by national budget reserves. The allocated budget is built in accordance with the size, task, transportation expense to deploy military units and their training, and other events. The RS deploys units, which can conduct independent operations, collaborating with other international forces, with combat support, protection and strategic airlift. The SAF is also part of NATO and the EU rapid deploying forces.[7]

All these present a challenge to the planners determining the right stock levels that will support future operations where in most cases the enemy, conditions, and the terrain is not a determent. Maintaining the national defense capability will be the primary mission, followed by collective defense, and alliance led operations, which all will present burdens to the National Defense Budget, with good planning, the burden can be reduced especially by “just enough” stocks.

The Resolution on General Long-Term Development and Equipping Program of the SAF up to 2025 is the long-term planning document providing the basis and the framework of national interest in the field of defense. Contemporary threats increasingly become more hybrid and multi layered in their form and international in nature because they are influenced by globalization. As a member of NATO and the EU, the SAF is engaged in implementing security and defense polices of both organizations and fulfilling membership related commitments. Military capabilities will be developed in line with NATO and the EU defense planning principle and with national and other operational experience, with the principle of effect base approach toward operations. In accordance with NATO criteria, 50 percent of the SAF troops will be deployable, so at least 50 percent of the SAF land component will be organized, equipped, and trained for potential operations outside national territory as part of integrated forces in an allied military structure. Ten percent of the SAF land forces will maintain a high level of readiness and participate in international missions and operations. The agreed sustainable contribution of the SAF forces to international operations, NATO response forces, the EU battle groups, reserve forces, and other forms of high readiness forces. Four BN task force units will be set up, trained, and capable of conducting decisive operations for up to one year long operations. These will be achieved by generating at list of four Combat BNs, which will represent the core of a battle group containing motorized Infantry and medium Infantry BNs.[8]

The total strength of the SAF is planned up to 10,000 personal with the target ratio between regular and voluntary contract reserve at 4:1, with 1:2:5 ratios among Officers, Non-Commissioned Officers and Soldiers, the category of military specialist

will be exclusively for specialist duties, with the tendency to downsize to 6 percent of the total SAF structure. With at least 2 percent of the Gross Domestic Product allocated for defense spending, of which 50 percent will be used on personnel related costs, 30 percent operational, and 20 percent on procurement, modernization, construction, research, and development that will support balanced development of the SAF. The military weapons and equipment procurement will be guided primarily by modularity, multipurpose, and interoperability with the equipment of allied militaries.[9]

Problem Statement

Logistical planning is based on historical data, experience, or on mathematical probability to estimate how much material will be used during various military operations. Ammunition planning involves even more variables that can influence a final planning product. There are different methods used for ammunition forecasting considering purpose (proficiency, basic marksmanship, mission shooting program, operations, etc.), ammunition type, unit type, controlled-ammunition types and climate influences. As the SAF operational tempo increases and future operations are assumed, it is essential that planners predict through forecasting methods, the appropriate amount of ammunition required at the strategic, operational, and tactical level that will support future operations. The planning product should not depend on the planner's professional judgment, but there should be a mathematical model in support of ammunition forecasting best suited for different operations and munitions types.

Research Question

The primary question in this thesis will answer: Is the current SAF ammunition forecasting methodology suitable in support of future military challenges?

Secondary questions that will enable an answer to the primary question:

1. What is the SAF strategic planning method?
2. What is the SAF operational planning method?
3. What is the SAF tactical planning method?
4. Are the SAF strategic, operational, and tactical planning methods synchronized?
5. What planning methods are used in NATO operations?
6. What are the planning methods used by different forces?
7. Which methodology should the SAF us to forecast ammunition?

Scope

This study will take into account the RS Defense Strategy and International Operation Strategy with the vision of the future of the SAF military operations. Standard SAF Infantry Brigade structure and equipment will be used as a building block for all calculations and comparisons, between the strategic, operational, and tactical level in support of national and collective defense, training requirements, and multinational operations. For the purpose of this study, the size and equipment of the units will be in accordance with the Resolution on General Long-Term Development and Equipping Program of the SAF.

Delimitation

This study will be limited to the small arms ammunition forecasting used in Infantry units and excludes all the Artillery, tank and other battle decisive munitions, in order to avoid security restrictions.

Disclaimer

The data calculated in this study are products of mathematical methodology and do not represent, the real SAF stock levels.

Significance to the Study

The object of this study is to evaluate and compare the current SAF ammunition six year forecasting method in support of the future operations and establishing validity for the future. Especially because more and more indicators show, there are discrepancies between planning at the strategic and operational levels, specifically in support of the missions. Facing reduction in defense budgets, the effects on procurement, manufacturing times, and on disposal of the obsolete ammunitions, the proper forecasting methodology will be crucial in order to fulfill all international obligations and maintain strong national defense capabilities.

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[1]NATO, *Functional Planning Guide-Logistic* (Oberammergau: NATO School, 1998), 28.

[2]Zeljko Kralj, *Slovenian Armed Forces Munition Planning Guidance* (Ljubljana: Republic of Slovenia, Ministry of Defense, 2004), 1-16.

[3]Ministry of Defence SVN, *SAF Mid-term Defense Program 2007-2012* (Ljubljana: Republic of Slovenia, Ministry of Defence, 2006), 1-66.

[4]Ministry of Defence SVN, *Resolution of the National Security Strategy of the Republic of Slovenia* (Ljubljana: Republic of Slovenia, Ministry of Defense, 2010), 4.

[5]Ibid., 20.

[6]Ibid., 40.

[7]Ministry of Defence SVN, *Intertnational Operation Strategy of the Republic of Slovenia* (Ljubljana: Republic of Slovenia, Ministry of Defence, 2010), 4-17.

[8]Ministry of Defence SVN, *Resolution on General Long-Term Development and Equipping Program of the Slovenian Armed Forces up to 2025* (Ljubljana: Republic of Slovenia, Ministry of Defense, 2011), 5-24.

[9]Ibid., 24-45.

CHAPTER 2

LITERATURE REVIEW

> My logisticians are a humorless lot . . . they know if my campaign fails, they are the first ones I will slay.
>
> — Alexander the Great,
> *Quotes for the Air Force Logistician*

SAF Ammunition Planning Method

The SAF Ammunition Forecasting Guidance is the logistic planner's primary document, which gives necessary elements and background in order to forecast strategic ammunition requirements considering national defense, operational, signal, and maximal national reserves.[1]

Among the NATO countries there are several different planning methods, therefore it is crucial to use common standards to evaluate supportability, with the common dominator as the SDOS, which is used by NATO during the planning process of developing stockpile requirements. The SDOS determines the amount of ammunition needed during one day of a standard fight, in accordance with Slovenia Army operations historical data. The SAF forecasting guidance is based on the;

1. MC 55/4 NATO Logistic Readiness and Sustainability Policy, 2003.
2. Bi–SC Stockpile Planning Guidance (SPG), 2004.
3. Directive for Logistic Support of Slovenian Armed Forces, 2003.
4. Allied Joint Logistic Doctrine, AJP-4.
5. Land Forces Logistic Doctrine, ALP-4.2.

The main objective of the planning guidance's is to provide effective planning of ammunition, in order to support national defense stocks, training, and coalition operations.

Planning Principles used in the SAF Strategic Ammunition Planning

The Mid-term National Defense Program matches a six-year ammunition planning cycle with biannual synchronization that optimizes ammunition stock with adjustments to potential changes in operational intensity. To support the planning process, planners evaluate various data that affect consumption, maintenance, procurement, and other factors such as: (1) type and amount of ammunition, (2) production and delivery time, (3) estimated increase of use, (4) additional ammunition testing, (5) stock quality, (6) time of employment for new ammunition, (7) documentation production time, (8) transportation, and (9) ammunition life cycle.

The SAF strategic ammunition stocks must support the uninterrupted processes of initial training, sustainment training, and operations in accordance with NATO and the EU alliance agreements while the national defense stocks are intact. A planning cycle calculates time for planning, procurement, sustainment, maintenance, transportation, and warehouse handling of the munitions.

Strategic ammunition forecasting in the SAF calculates safety, signal, and maximal stocks as shown in the figure 1.

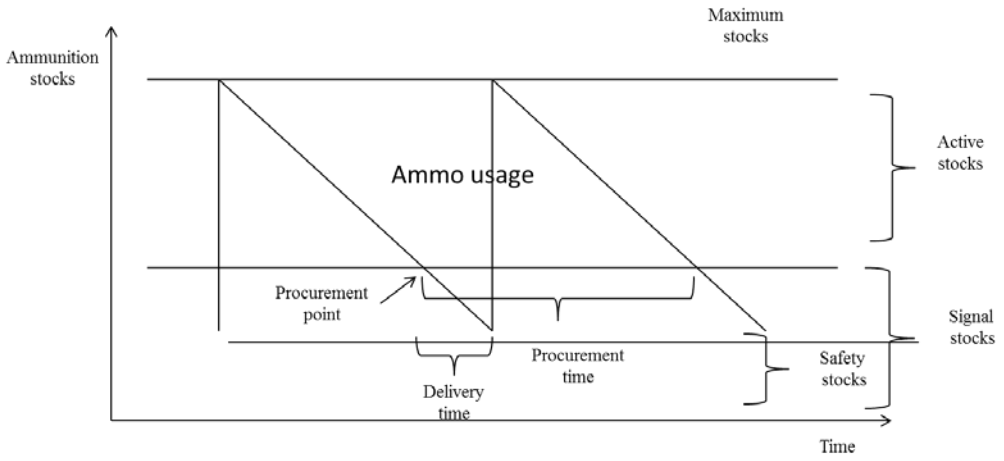

Figure 1. Dynamic of Ammunition Stocks

Source: Republic of Slovenia, Ministry of Defense, *Guidance for Ammunition Planning* (Ljubljana: General Staff of Slovenian Army, June 2004), 8.

Figure 1 shows the dynamic of the ammunition stock level related to time and SAF ammunition usage. Safety stock is the minimum amount of the ammunition reserved for national defense, depending on the threat level. Signal stock level is the minimum level with which the SAF can still execute all planned training tasks and operations, but has to start the procurement procedures. The signal stock level is mainly dependent on the operational intensity and time needed to execute the ammunition procurement process. Available storage capacities and ammunition "shelf life" limits maximum ammunition stock levels.

SAF planners are using two different methodologies, LOE and TOM. The LOE Methodology bases the average daily consumption in combat operations and is usually used to calculate the consumption of ammunition in calibers lower than 20mm.[2]

The TOM uses the statistical data of the battle decisive munitions used to eliminate the enemy with 95 percent probability not in relation to the time, this method is

usually used for ammunition of calibers bigger than or equal to 20mm, in both cases, quantities are expressed as DOS.[3]

SAF Level of Effort Methodology

The SAF LOE planning methodology uses a standard day of supplies Q_{SDOS} as a planning variable, estimated as the statistical average amount of ammunition used during SAF operations. Statistics shows that the average expenditure on the strategic level is approximately 10 percent of the BL to the weapon system. In this study, 10 percent of the BL will equate to a standard day of supplies $Q_{SDOS.}$ The SAF BL is a quantity of ammunition allocated to the weapon system in accordance with the technical specification.[4]

Safety stocks are determined by the sum of four parts (Appendix A). The first part regulates the level of the strategic reserves by the amount of the weapon systems in the armament ($Q_{OR.OB}$) multiplied by a sustainment factor. The sustainment factor (M) represents the level of the required self-sustainment on the national level using factors higher than 15, which represent 15 days of sustainment. The second part calculates average consumption during different combat postures, dependent on the amount of weapons systems actually engaging in combat ($Q^{i}_{OR.DE}$) and the operational intensity for each independent operation (L_i)**.** The combat intensity (L_i) factor describes the numerical level of intensity for each engagement such as offense, defense, or any other tactical task depending on intensity as low, moderate, or high. The third part calculates training requirements with the amount of weapons systems ($Q^{i}_{OR.DE}$) in use at different levels (N_i) of training: initial, sustainment, and mission readiness gunnery. Finally the fourth part determines the amount of munitions needed for annual training in general relation to the

annual level of training intensity (N_k) and all weapon systems in use in the force ($Q_{OR.UP}$). The training intensity factor (N_k) is usually greater or equal to 4, for smaller caliber (less than 20mm) and more or equal to 2 for bigger calibers (more or equal than 20mm).

Maximum stock level is limited by the available storage capacity and the munitions shelf life (Appendix A). Factors that influence the level of max munitions stock are combat intensity in planned time frame (L_i), yearly training factors (N_i), yearly training intensity of unit category (N_k), weapon systems in use in total ($Q_{OR.UP}$) and for each individual task ($Q_{OR.DE}$) and the most distinct factor the munitions shelf life. Ammunition shelf life would be considered as the time from production to the time when the ammunition becomes unstable and dangerous to use, the shelf life is determined by chemical composition of propellant and explosives used in the munitions. The storage conditions are the biggest external influence on ammo shelf life.

The last calculated category is signal stock (Appendix A). This category is mostly affected by munitions delivery time, which represents the period from the start of the procurement process to the actual delivery date. Most countries are struggling with constant military budget cuts and great efforts are in place to make their military more efficient. One of the additional approaches to becoming more efficient is to reduce the ammunition stocks and delivery of it with the “just in time” principle. However, in reality many obstacles are influencing nations in managing national stocks, the international munitions industry fluctuates in response to global levels of conflict, minimum order quantity, which effects especially small nations, and others influences.

SAF Target Oriented Methodology

The TOM is a broadly used ammunition planning methodology; it poses the question how many munitions do we require to destroy a set of enemy targets? The method needs a clear definition of the future enemy and from there the set of targets and the best munitions to use in order to destroy them. The TOM is not time dependent which means that it will take the same amount of ammunition to defeat the enemy targets regardless of when is it done, i.e. tomorrow, in a week, or in a year. Time independence presents one of the advantages in comparison to the other methods but there are some examples where this method could run in to a problem. For example; destroying a bridge or runway that can be rebuilt or in case of insurgent troops, which can be recruited from other sources or imported to the theater. In these cases, the number of enemy targets to be destroyed is a function of time and therefore the ammunition requirement is effected with the duration of operation.[5]

The mathematical formula used in the SAF TOM is similar to the LOE method. The main distinction is the probability factor used to determine 95 percent probabilities in destroying enemy targets for each independent operation, with the specific combat posture (Appendix A).

Even though SAF implemented both methodologies LOE and TOM and also projected implementation of the NATO ammunition planning tool the Allied Command Resource Optimization Software System (ACROSS), the reality is, that most of the time the strategic planners are using only the LOE method to forecast ammunition, including battle decisive munitions. Mathematical results are revised and planners are using their professional judgment and experience in order to optimize final planning product.

SAF Operational Planning Method

LOE is the SAF operational level planning method, consumption rates based on NATO consumption rates for defense, offence, and delay operation. SAF Force Command is responsible for collecting the ammunition data from all operations areas, in order to change and improve the planning factors and statistical average consumptions per weapon system.[6]

Table 1. SAF Operational Planning Data

Weapon system	Ammunition Caliber	BL (rounds)	BN and higher DOS (rounds/weapon)	CO or lower units DOS (rounds/weapon)
Pistol	9x19 mm	30	2	3
Assault rifle	5.56x45 mm	210	59	85
Light machine gun	5.56x45 mm	660	84	120
Medium machine gun	7.62x51 mm	1,500	84	120
Sniper rifle	7.62x51 mm	50	7	10
Sniper rifle	8.6x70 mm	50	7	10
Sniper rifle	12.7x99 mm	50	4	7
Heavy machine gun	12.7x99 mm	6	168	240
Grenade launcher	40x46 mm	60	2	3
Automatic grenade launcher	40x53 mm	48	49	70

Source: Republic of Slovenia, Ministry of Defense, *Guidance for Logistic Operational Planning* (Ljubljana: General Staff of Slovenian Army, 2006), 5.

Table 2. Operational Ammunition Planning Modification Factors		
Type of Modification Factor	Description	Combat Factor
Combat	Defense	1.5
	Offense	2.5
	Delay	2
	Retrograde	1
	Uncommitted	1

Source: Republic of Slovenia, Ministry of Defense, *Guidance for Logistic Operational Planning* (Ljubljana: General Staff of Slovenian Army, 2006), 5.

SAF usually deploys company task force or BN, and at any given time, 10 percent of the SAF is deployed to the NATO, UN or the EU missions. In accordance with the Contingence Plan and the units Operational Order, the logistic planners are determining unit average combat posture and use it in calculation. The DOS, depending on the size of the unit, is multiplied by combat factors representing the combat posture and the number of weapon systems that are deployed. The final product represents the Combat Day of Supplies, which is the calculated amount of munitions that should be provided to the deploying unit in order to establish the required Readiness level. The Contingence Plan could provide more detailed guidance to certain types of munitions, in those cases, consumption rates are used in accordance with the Contingence Plan recommendations.

In Accordance with the current MC5/4 NATO Readiness and Sustainability Policy, all SAF units in a deployment have 30 DOS "on hand."[7] Stock level on hand depends on the units capabilities to transport and sustain itself during operation. SAF BNs can hold three DOS and the brigade or the battle group will have an additional four DOS on hand, as shown in table 3.

National Support Element is the third level of logistic support on the ground, with a minimum of five days on hand and 18 DOS inbound to the theater of operation.[8] The level of the supplies in the theater can change depending on the threat level, whether units are operating from the Forward Operating Base or they are mobile, and the time needed to get supplies in the theater. The level of supplies can change on all levels depending on the situation in the theater of operation. A contributing Nation's Commander states via the Sustainability Statement to the NATO Commander, that he has the required logistic capabilities to conduct operations.

Table 3. SAF Operational Stock Levels			
30 DOS			
7 DOS		23 DOS	
3 DOS	4 DOS	5 DOS	18 DOS
First level	Second level	Third level	Forth level
Battalion	Battle Group/Brigade	National Support Element	SAF/Transport

Source: Republic of Slovenia, Ministry of Defense, *SAF Order–Operational Sustainment* (Ljubljana: General Staff of Slovenian Army, October 2010), Annex C, 1.

SAF Tactical Planning Method

SAF tactical ammunition planning factors are dependent on the type of weapon system used during predicted types of combat operation.[9] The tactical method used in SAF Brigade and subordinate units is the LOE methodology, with the same planning factors as operational with BL added, the same method is used also for battle decisive

munitions. The DOS data used in calculations is historical data representing average daily ammunition consumption during SAF operations and are evaluated yearly and changed if necessary. The same data is used for planning ammunition during live fire tactical exercises.

Table 4. Tactical Ammunition Planning Matrix

Weapon system	Ammunition Caliber	Basic Load (BL) (rounds)	BN and higher DOS (rounds/weapon)	CO or lower units DOS (rounds/weapon)
Pistol	9x19 mm	30	2	3
Assault rifle	5.56x45 mm	210	59	85
Light machine gun	5.56x45 mm	660	84	120
Medium machine gun	7.62x51 mm	1500	84	120
Sniper rifle	7.62x51 mm	50	7	10
Sniper rifle	8.6x70 mm	50	7	10
Sniper rifle	12.7x99 mm	50	4	7
Heavy machine gun	12.7x99 mm	1200	168	240
Grenade launcher	40x46 mm	6	2	3
Automatic grenade launcher	40x53 mm	320	49	70
Mortar	81mm	60	11	0
Mortar	120mm	48	11	0
AT		4	2	2

Source: Republic of Slovenia, Ministry of Defense, *Guidance for Logistic Tactical Planning* (Ljubljana: 1.BDE SAF, October 2006), 15.

On the tactical level, planning for each weapon system, the BL and the Combat DOS presents the base pack for the planner (Appendix A).

SAF Operational Training Ammunition Planning

SAF Marksmen and Gunnery programs support planning and execution of basic marksmen training, annual qualification for combat and non-combat units, reserve units, and pre-deployment training.[10] In accordance with the SAF Order, Training Ammunition and Gunnery programs; which describe the conditions to conduct basic gunnery training, qualification, and pre-deployment gunnery as well as the authorized amount of munitions for each task.[11]

The SAF Gunnery Training Program is the foundation for planning, for "training ammunition," which consists of initial, sustainment, and mission training. Every soldier conducts initial marksmanship training during their initial training to include the reserve component. It includes zeroing and basic expert shooters tasks, universal for all types of units. Upon completion, solders are assigned to their units for Military Occupation Specialties Training where advance marksmen training is conducted, followed by annual sustainment training, and qualification, the program varies between combat, combat service support, service support, and reserve units. Sustainment training is usually conducted in the active and reserve units as part of their training cycle that consists once again, of zeroing, sustaining marksmanship, and annual qualification.

The SAF Mission Gunnery Program is distinct: personal weapons, crew served weapons, and tactical gunnery. The tactical gunnery is conducted during the training cycle and Mission Readiness Exercise where units are finally evaluated before deployment. A standard training sequence for SAF unit is 30 months, of which six months is consolidation and reorganization, 12 months is training, and 12 months is readiness and deployment. Considering the size of the SAF, one maneuver BN along with

the additional supporting elements is in each phase of the operational cycle. The rest of the SAF ground forces are in the supporting, readiness phases or deployed.

Table 5. SAF Marksmanship and Gunnery Program 5.56mm Ammunition Requirement			
Program	No. of tasks	Ammunition (rounds/soldier)	Remarks
Basic marksmen	10	465	Basic soldier training
Advance marksmen–Combat Arms	15	698	
		90	Annual qualification
Sustainment training-Combat Arms	5	283	Reserve units
		90	Annual qualification
Advance marksmen–Combat Support	10	465	
		75	Annual qualification
Sustainment training-Combat support	5	220	Reserve units
		75	Annual qualification

Source: Republic of Slovenia, Ministry of Defense, *SAF Marksmen and Gunnery Programs* (Ljubljana: General Staff of Slovenian Army, May 2012), 25-35.

NATO Ammunition Planning Principles

"The successful planning, execution and support of military operations requires a clearly understood doctrine, and this is especially important when operations are to be conducted by Allied, multinational or coalition forces. Allied Joint Publication-01 (AJP-01) provides the "capstone" doctrine for the planning, execution, and support of Allied joint operations. Even though NATO publication are primary intended for NATO forces, the same doctrine is applied during operations under the command of the European

Union (EU), or a coalition of NATO and non-NATO nations within the framework of a Combined Joint Task Force (CJTF)."[12]

The main NATO logistic policies; nations have the responsibility for equipping, training, and sustaining their deploying forces, individually or collectively by multinational agreements during NATO led operations. National Support Elements play the main role in coordinating and providing national support, as well as integration into the NATO multinational logistic coordination body. Troop contributing nations are providing troops, equipment, and support defined in the Contingence Plan, NATO provides very limited support, which is usually contracted through the NATO Maintenance and Supply Agency. Nations will give Transfer of Authority of their contributing troops and equipment to NATO Commanders for the duration of the operation or a specifically determined time. Multinational Integrated Logistic Units can integrate multinational capabilities, logistic forces, and equipment, if so determined, during the force generation process.[13]

Determination of NATO Logistic Requirements

"NATO Logistic requirements are determined by applying the logistic planning factors against the tasks outlined in the mission analysis."[14] Logistic planning factors are, determining the amount of supplies per man/vehicle/kg, which cannot be used to plan resources in detail.

The NATO functional planning guide provides consumption planning factors and guidance used to determine the logistic requirement, assessing support capabilities, and determining the logistics architecture. Consumption planning factors can be used to

estimate operational level planning, with no consideration for weather or terrain factors. These figures are valid for Article V (combat) and Peace Support Operation (PSO).[15]

Table 6. NATO Operational Planning Factors

Consumable Category	Consumption		Operational Multiplayer		Stowage factor	
Ammunition	Rate	Unit	Combat	PSO		
Explosives	15	Kg/man	1.0	0.1	0.0011	m^3

Source: NATO School Oberammergau, *NATO Functional Planning Guide* (Oberammergau: NATO School, December 1998), 29.

With NATO led operations, the troop contributing nations are providing a capability statement to the regional commander or to the commander to whom they are subordinate, stating that they have adequate supplies to conduct operations required, in the Concept of Operation. The main document for NATO ammunition planning is NATO Military Committee Readiness and Sustainability Policy MC55/4 and Bi-SC (SPG). Providing more precise planning stock criteria, in terms of DOS will be determined based on the sustainability statement, agreed upon by the "Sending Nations" for a particular operation, and published in the logistic annex to the operation order**.** Stocks for sustained operations will include organic unit stocks, plus additional stocks maintained at support levels, necessary to cover the order and shipping time for supplies. The actual positioning of supplies will be dependent on the operational situation and the ability of strategic and tactical transport to move supplies forward into the Joint Area of Operations. Other factors that will influence stock levels and locations include the political situation, the

risk to which the stocks will be exposed, and the cost effectiveness of holding stocks forward, against the resupply of stocks from home bases.[16]

Process of Building the Stockpile Planning Guidance

NATO MC55/4 Readiness and Sustainability Policy; nations should maintain appropriately sufficient supplies, available within the readiness categories, to sustain their forces committed to NATO led operations for the full range of potential missions, as identified in the Defense Requirement Review. Nations must ensure that, within the preparation time of individual readiness categories, the readiness stockpile requirements for forces in those categories, meet the sustainability requirements as:[17]

1. Maintaining adequate stocks.
2. Assured access to industrial capabilities with adequate surge capacity.
3. Bi Military Committee/multilateral agreements.
4. Contingency contracts.
5. Other means, including contractor support to operations.
6. Nations relying on industrial surge to address requirements must ensure that industry has the capacity to respond in the timescales required and over the duration necessary, particularly where suppliers may be asked to respond to the needs of more than one nation and/or to the civil sector.18

The NATO process of developing stockpile requirements principally determines the level of 30 SDOS. Each unit is required to deploy with 30 SDOS ready to use in case the nation cannot meet the level of readiness, nations find alternative solutions to achieve these requirements.

National stockpile level requirements will be addressed in the SPG where the Supreme Commanders, during the Defense Planning process develop the guidance for SPG. The SPG is issued to the NATO countries every two years and represents the NATO requirements for all classes of supplies (including class V-ammunition), conferment by the nations in the SPG committee. In cases where the SPG cannot be given, the nations apply their national planning factors. The SPG computes the optimal munitions effectiveness based on current inventories and planned procurement, and then reports the results in the Defense Planning Questionnaire. Shortfalls in meeting the agreed munitions or other stockpile levels are discussed at the Senior Planning Committee and during force planning consultations with nations. NATO SPG uses the computer base application to calculate battle decisive munitions, using the TOM implemented by the calculation module ACROSS.[19]

NATO Planning Tool ACROSS

The NATO SPG document determines the appropriate munitions planning methodology. Battle decisive munitions should be calculated in accordance with the TOM, all small arms munitions will utilize the LOE Methodology. Both forecasting principles are used in the NATO based software program called ACROSS. All battle decisive munitions are calculated with the TOM that include artillery, antitank, and tank munitions, in general all munitions with the caliber equal or above 20mm excluding mines, grenades, and light short range anti-tank munitions. The TOM uses the Extend data, of the enemy targets, friendly forces, and operational parameters, working in a time independent environment which can be used in both short and long mission durations.[20]

Using ACROSS, small arms with the calibers less than 20mm, mines, grenades, and light short-range anti-tank munitions are calculated in accordance to the LOE methodology. Using average consumption rates that consider time, intensity, number of consumers, and combat intensity, LOE is the more traditional methodology where the consumption and stock levels are expressed in DOS.[21]

ACROSS uses the two main mathematical approaches to optimize the ammunition planning, one is using the total cost associated with destroying all the targets, while the second identifies how many targets the available ammunitions can destroy. Even then, ACROSS contains a broad database, each nation still has to input their force data for their specific munitions and the cost of the ammunition.[22]

ACROSS is not without its limitations. One of the main limitations is indirect fire, which is used for area targets and not for point targets, which forms the basis for TOM. Another is double counting targets, which can be destroyed by direct and indirect fire weapons. The NATO C3 Agency is working closely to improve the software by correcting known errors and addressing new recommendations for improvement. Indirect fire in TOM will be addressed as area target, calculating variables such as whether the target is protected or not protected and making distinctions between destroyed and neutralized. “The software will recognize the difference between close combat and the deep targets beyond the range of the mortars. Finally, illumination and smoke rounds are not considered as battle decisive munitions but are more related to the support fire missions which together with neutralizing terrain features should be included in the LOE calculation.”[23]

Canadian Approach to the Ammunition Planning

The Canadian approach is consistent with Supreme Headquarters Allied Powers Europe SPG. Considering funding reductions, the stockpile level was set to the level of 60 days, 30 basic and 30 days sustainment level for mid intensity operations. The ratio was a compromise to the available funds and existing stock levels.[24]

Knowing that NATO SPG is based on the historical data from World War II and the Korean War, Canadian Ammunition Working Group reviews stockpiling criteria. This approach is due to the global threat reduction and emphasis on potential contingency operations including state training component, transition component, and operational stocks.

Canadians Working Group developed a SPG program named the Marginal Analyses Planning Program that was developed by J4 Logistics Analysis at the National Defense Headquarters in Ottawa. The Marginal Analyses Planning Program uses the TOM requiring a target list and database of single shot kill probability for each munitions against various targets. Compared with NATO ACROSS, the Canadian Marginal Analyses Planning Program was missing an internal database of weapon systems and platform data which did not consider time and space. These factors affect the firing platform accuracy and lack of output data analysis.[25]

Canadian forces also use LOE methodology. LOE methodology is a very robust baseline using historical or simulation data to determine consumption rates for a given weapon system and is not dependent on specific scenarios. These were the usual Canadian planning approaches used for simple calculations for many munitions types, but it gets more complicated with special characteristic munitions. In the past, battle decision

munitions planning was addressed by “expert opinion” but now with the software programming of ACROSS and Marginal Analyses Planning Program, TOM can be more precise.[26]

Dr. Andrews and Dr. Hurley from the Royal Military College of Canada proposed to reduce the limitations of both planning methodologies by the Operational Stock Planning Process.[27] This process incorporates professional military judgment, war gaming output, historical models, and activity based modeling to determine operational stockpiles. This model is different from the Marginal Analyses Planning Program and ACROSS, in that it employs a mix of Target Oriented and LOE methodologies. The Operational Stock Planning Process consists of three stages: the scenario development stage, the stockpile estimate stage, and the approval stage.[28]

The scenario stage defines the 11 force planning scenarios approved by Joint Intelligence, Joint Operations, and the Joint Logistics staff. The stockpile estimate stage determines the scale proposed on the model known as Operational Stock Calculator, blending LOE and Target Oriented methodologies considering conflict break points, suppression and speculated fire, and logistical attrition loss. The model makes provisions that the estimated parameters are correct.[29] Finally, the approval stage uses the application of professional judgment, war gaming, and historical precedent to validate the calculations.

As shown, the intent of the Canadian forces was to adopt a new planning process in order to reduce national ammunition stockpiles and at the same time fulfill the sustainment requirement of 60 DOS for a main contingency force.[30]

Great Britain Planning Approach

The British method to determinate the level of the ammunition stocks is based on the NATO SPG or on the historical data used by LOE Methodology, depending on the circumstances. The British concept uses one or the other methodology whichever had better support to the planning process. In the end historical data, modeling, or professional judgment determines actual munitions levels.[31]

US Stockpile Planning Approaches

The Capabilities Based Munitions Requirements Process determines US ammunition forecasts. Different offices determine munitions requirements by two main factors: the friendly force structure and the enemy threat with the Target Oriented Approach.[32] US Armed Services have been using seven different ammunition planning methodologies. The Navy and the Air Force apply the distinction between LOE and Threat methodologies. The Marine Corps is using the model Target Oriented Level of Effort and Shooter Oriented Level of Effort. The Army is using the theater simulation model.[33]

US Army Munitions Planning

Theater Simulation Methodology calculates the majority of Army munitions ranging from small arms to artillery, tank rounds, and missiles, shown in figure 2, which separate different theaters, in accordance to the Defense Guidance Scenario.[34]

Army Theater Simulation Methodology uses the Combat Sample Generator, in order to generate samples of 24 hours of combat. Using a US Army Division opposed by an enemy Division with the inputs of weapon systems, detection and kill probabilities,

terrain and environmental data, the Combat Sample Generator will use doctrine and tactics to describe the different force postures: attack, defense-intense, defense-light, and delay. The results are in categories: first, the killer–victim ration, expected army targets killed by the enemy and enemy targets killed by the US armed forces. Second, the category represents the number of the engaged weapons systems according to the friendly/enemy, type and posture. Third, is the munitions expenditure during a 24 hour operation on both sides.[35]

Furthermore, the Attrition Module calculates the attrition and the munitions expenditures. Attrition Calibration Module data supports the theater simulation Concept Evaluation Model which takes a specific deployed US force associated with the specific Operational Plan. The Concept Evaluation Model synchronizes war simulation inputs for theater of operation for the duration in accordance to the Defense Guidance. All data is then fed into the Ammunition Post Processor for a final forecast calculation. Forty five percent of all Army munitions are forecasted through the Ammunition Post Processor which represents high cost munitions as 90 percent of all munitions spending, the remaining 10 percent of the munitions budget consists of small arms munitions, grenades, and non–artillery munitions.[36]

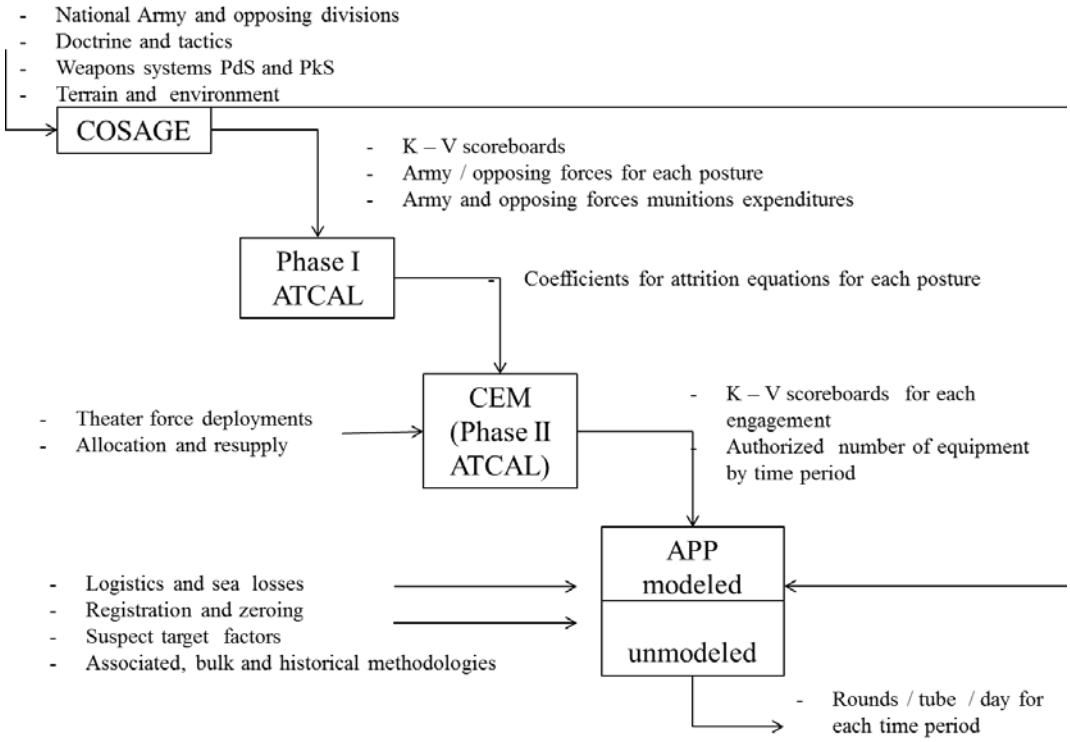

Figure 2. US Army Theater Simulation Methodology

Source: David Kassing, Gordon Crawford, Kenneth J. Girardini, and Gerald C. Sumner, *Estimating Conventional Munitions Requirements* (Santa Monica, CA: RAND Corporation, 1991), 16.

To calculate the war reserve resupply requirements, the Army uses the rates of round per weapon per day with an estimated number of weapons in the theatre. The Army Initial Issue Quantity requirements for mobilization training, war reserve stocks for allies and special activities present 40 percent of total ammunition procurement.[37]

The method has several strengths; first, the comparisons of two sides of combat simulations, simultaneous tracking target availability to destroy target and ability to supply the army with the ammunition. Second, attrition of both forces is tracked in the module and the theater simulation quickly compares the theater combat resolutions.[38]

The model also has some limitations: the inability to consider effect to the uncertainties on the enemy and US Army operations and resupply. The modules biggest difficulties are the level of details and the time required to calculate and to perform the simulation, for a single theater of operation.[39]

USMC Munitions Planning

The US Marines use several models to forecast their munitions: the two most used are Level of Effort-Shooter Oriented (figure 3) and Level of Effort-Target Oriented (figure 4). These two methods enable the Marines to forecast more than three quarters of their ground ammunition. It seems that there is little difference between the two planning methods, considering they are both LOE. However, this is not the case; Level of Effort-Target Oriented is similar to the models that are categorized as Threat Models. Both models rely on data from a model called Troop Population Model, which tracks the number of combat active Marines in the operational scenario.[40]

USMC Level of Effort-Shooter Oriented Method

The Model uses a Marine Expeditionary Force engaged in 180 days of a sustained operation. During which the Marine Expeditionary Force is constantly changing its fighting posture (offence, defense, delay, retrograde, etc.). The model calculates Marine losses during different postures down to the "reconstruction level" after which the Marine Expeditionary Force is reconstructed to full strength. The Level of Effort-Shooter Oriented methodology drives data from Troop Population Model and calculates the amount of rounds fired by each Marine every hour during different combat postures. In addition to the previously discussed LOE methodology, the Level of Effort-Shooter

Oriented method sums the BL and the zeroing allowance for each weapon system. Finally, the total munitions expenditure is divided by a 30 day period and increased by a factor for "logistical loss."[41]

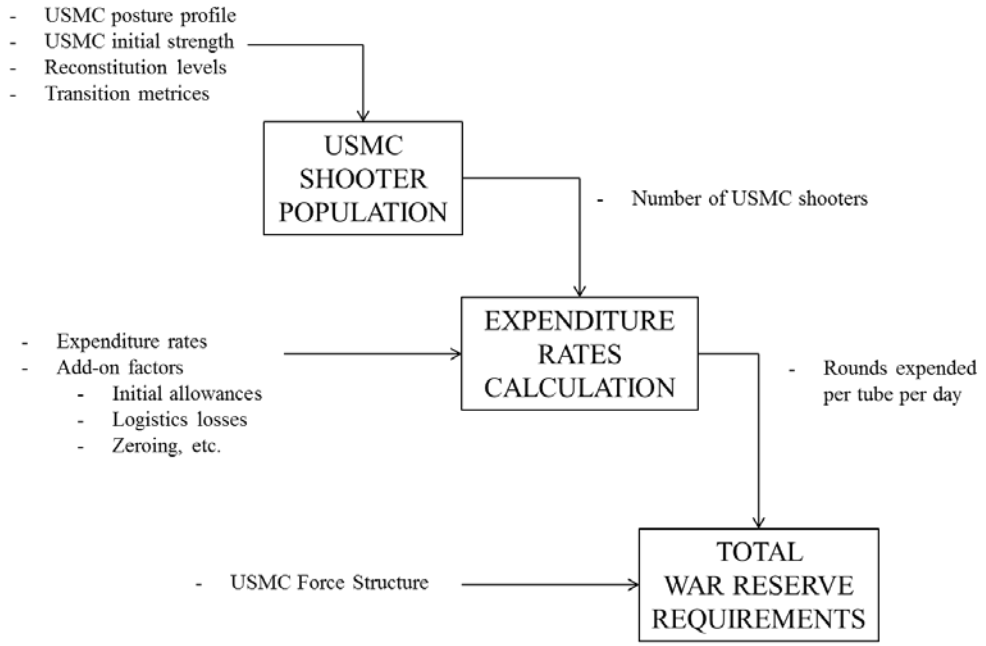

Figure 3. USMC Level of Effort-Shooter Oriented Methodology

Source: David Kassing, Gordon Crawford, Kenneth J. Girardini, and Gerald C. Sumner, *Estimating Conventional Munitions Requirements* (Santa Monica, CA: RAND Corporation, 1991), 20.

This method is appropriate in the target rich environment. The main forecasting factors are: (1) the size of the Marine Force, (2) combat posture, (3) casualty rate, (4) the reconstruction level, (5) the expenditure for each combat posture, (6) the size of the BL, and (7) logistical loss rate. There is some consideration about the uncertainly of data describing the combat postures, casualties, expenditure rate, and logistic losses.[42]

USMC Level of Effort-Target Oriented Method

Level of Effort-Target Oriented is a complex methodology and contains several steps; size of the threat, Marine troop losses from the Troop Population Model, force exchange ratio, force ratio, and Equivalent Threat Division.

The Marine model defines Equivalent Threat Division as an equivalent to a Marine Division encountered in different scenario based combat postures, with the total targets given as well. The targets attacked by any force other than the ground force are removed from the poll. The Marines do not plan the type of munitions to destroy all the targets; instead, calculations are entered to destroy a proportion of the enemy threat. This is accomplished by relating the number of enemy targets destroyed to estimated Marine Corps casualties, from the Troop Population Model. The total targets are then divided among several periods within the scenario. At this phase, the division and enemy force are set in a fixed combat posture, and different munitions that Marines can use to destroy the force are inserted in the model. Dividing the munitions is mainly determined by the Marine Corps professional judgment; many times, they use the Army Combat Sample Generator analysis. The probability to kill is used to determine the amount of rounds to kill the enemy targets. Followed by the calculation for the munitions reserve; the calculation assumes that the targets are not equally distributed among the shooters. The distribution of the targets is modeled as a Bose–Einstein distribution, some shooters see more targets than others do and they cannot destroy all of the targets with the limited assigned allowance. The munitions reserve is used as replenished munitions for these shooters. The Marine Corps Level of Effort-Target Oriented Methodology combined the initial shooter munitions allowance, reserve munitions, and the logistic losses. The

requirements are expressed as round per tube per day, multiplied by the amount of tubes, shows the total requirement of the United States Marine Corps (USMC) in accordance to the Level of Effort-Target Oriented Methodology.[43]

This process is very complex and shows some weaknesses, the Level of Effort-Target Oriented approach ignores uncertainty about the total amount of target; the Bose–Einstein distribution parameter has not been validated with historical combat data and splits the target among the munitions, so it strongly involves the USMC professional judgment in a planning process.

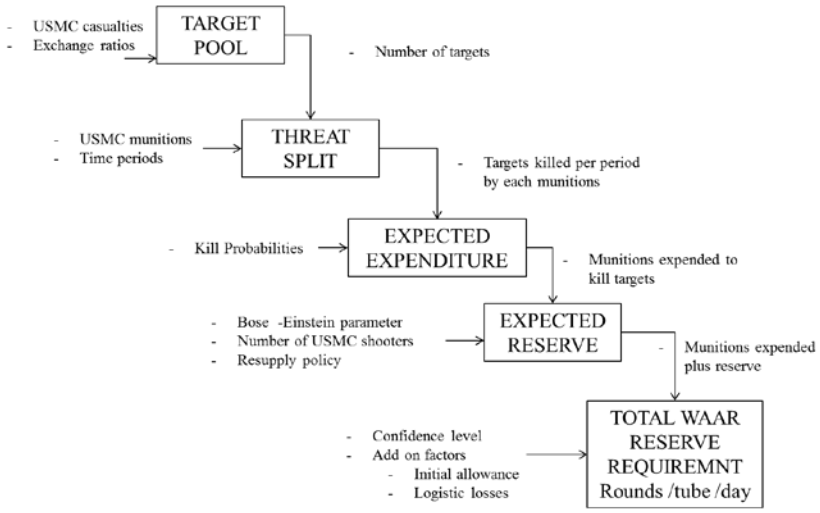

Figure 4. USMC Level of Effort-Target Oriented Methodology

Source: David Kassing, Gordon Crawford, Kenneth J. Girardini, and Gerald C. Sumner, *Estimating Conventional Munitions Requirements* (Santa Monica, CA: RAND Corporation, 1991), 22.

[1]Kralj, 1-16.

[2]Ibid., 9.

[3]Ibid.

[4]Ibid.

[5]Phil Guy, *Strategic Munitions Planning in Non- Conventional Asymetric Operations* (Hague: NATO C3 Agency, n.d.). 16-8.

[6]Republic of Slovenia, Ministry of Defense, *Logistic Operational Planning Criteria of SAF* (Ljubljana: Ministry of Defense SVN, 2006), 2.

[7]Ibid., 7.

[8]SAF Force Command, *Slovenian Armed Forces Sustainment* [Ukaz za oskrbovanje SV] (Ljubljana: Republic of Slovenina, Ministry of Defense, 2011), Annex C, 1.

[9]Republic of Slovenia, Ministry of Defense, *Logistic Operational Planning Criteria of SAF*, 1-12.

[10]Republic of Slovenia, Ministry of Defense, *SAF Gunnery Program (Tablice strelijanja). Order* (Ljubljana: Ministry of Defense, General Staff of the Slovenina Army, 2012), 1-150.

[11]SAF Force Command, *Operational and Training Ammunition Sustainmet* [Ukaz za zagotavljanje bojnega SIMES ter vadbenih sredstev za usposabljanje poveljstev in enoty SV v letu 2012] (Ljubljana: Republic of Slovenia, Ministry of Defense, 2012), 1-15.

[12]North Atlantic Treaty Organization, *Allied Joint Logistic Doctrine AJP-1(D)* (Brussels: NATO, 2010), XI.

[13]North Atlantic Treaty Organization, *Allied Joint Logistic Doctrine, AJP(A)-4* (Brussels: NATO, 2003), 1-2.

[14]Ibid., 3-8.

[15]NATO. *Functional Planning Guide-Logistics*, 29.

[16]Ibid., 4-3.

[17]NATO Defence Policy and Planning Division, Logistic, *The NATO Logistics Handbook* (Brussels: NATO HQ, 2007), 48.

[18]Ibid., 48-49.

[19]Ibid., 49.

[20]William S. Andrews, and William J. Hurley, “Approaches to Determining Army Operational Stockpile Levels, *Canadian Military Journal* 5, no. 2 (Summer 2004): 40.

[21]Ibid.

[22]Ibid.

[23]Ibid., 41.

[24]Ibid., 37.

[25]Ibid., 41.

[26]Ibid., 42.

[27]Ibid., 44.

[28]Ibid.

[29]Ibid., 45.

[30]Ibid.

[31]Ibid., 42.

[32]Ibid.

[33]David Kassing, Gordon Crawford, Kenneth Girardini, and Gerald Sumner, *Estimating Conventional Munitions Requirements* (Research Project, Santa Monica: RAND Corporation, 1991), V.

[34]Ibid., 16.

[35]Ibid., 17.

[36]Ibid.

[37]Ibid., 18.

[38]Ibid.

[39]Ibid., 19.

[40]Ibid.

[41]Ibid., 20.

[42]Ibid., 21.

[43]Ibid., 21-23.

CHAPTER 3

RESEARCH METHODOLOGY

> The amount of ammunition required for any operation is not subject to very accurate determination. Generally speaking, the more ammunition that is fired, the easier it is for us to advance and the lower are our casualties.
>
> — Gen Carter B. Magruder, USA,
> *Quotes for the Air Force Logistician*

The purpose of this chapter is to identify the analysis necessary to formulate the conclusions and recommendations concerning the current strategic SAF ammunition forecasting method, in conjunction with the subordinate planning methods and requirements used at the operational and tactical level.

The method used for analysis in this study will be quantitative: focusing on the current SAF ammunition forecasting method using LOE methodology. To compare SAF forecasting methods strategic calculations will be compared with operational and training ammunition requirements, considering the National Defense Strategy and SAF, NATO, and the EU alliance commitment.

Strategic planning considerations:

1. Force structure of 10.000 troops of which 25 percent are reserve units.
2. Fifty percent of the total SAF forces are deployable as NATO, EU or as other coalition forces.
3. Ten percent of the total strength is constantly deployed.
4. Deployable formation is BN or company size task force.
5. Basic school—BN size unit.
6. SAF minimum 15 DOS self-sustain.

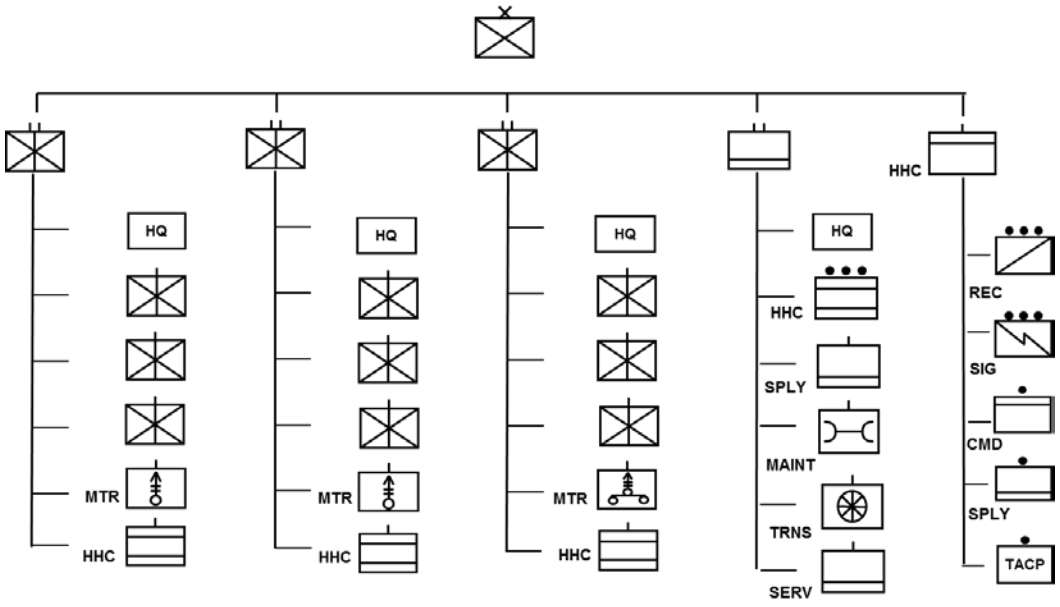

Figure 5. SAF Brigade Organization Diagram

Source: Created by author.

In order to compare different levels of planning methods in the SAF, the LOE methodology will be used as the primary methodology in this study. To evaluate strategic training ammunition forecasting the SAF Marksmanship Training Program will be used, considering the SAF unit operational cycle.

In this study, the force structure and the equipment is modeled to support a future SAF layout, synchronized with the Resolution on General Long-Term Development and Equipping Program of the SAF that is matched with National Security Strategy of the RS. The 4:1 ratio between active and reserve forces will be considered, as well as the additional Infantry Brigade size unit of equipment in stocks. Infantry BN task force will be considered as deploying and mission training force.

Even though the LOE methodology will be used throughout all levels of planning, the planning factors would be used as represented in chapter 2. Forecasting, the worst-case scenario will be considered as max troops deployed, conducting training cycle, and worst-case scenario of the national defense. Results of planned munitions compared between strategic and operational planning while considering training ammunition, operational, national defense requirements, and analyzing to total balance between planning levels. This study will also address influence of the different consumption rates and planning factors on planning accuracy.

This study will support the position of the current SAF munitions forecasting method, supporting future Slovenian forces contributions in NATO and Coalition led operations. Recommendations address the necessary changes in the SAF ammunition forecasting methodology with new ideas of optimizing the planning process.

CHAPTER 4

ANALYSIS

> The most precious thing when in contact with the enemy is ammunition.
> — Gen Kurt Student, Luftwaffe,
> *Quotes for the Air Force Logistician*

With all collected data in the literature review, this chapter will answer the primary question: is the current SAF ammunition forecasting methodology suitable in support of future military challenges? The primary question will be answered with the analysis of this study from the perspective of training, operations, national defense, ammunition requirement, and how operational needs effect the strategic planning.

The research involves the SAF, NATO, and other available documents, sources, and partiality from personal experience working in the field of logistics, supported by calculations based on the SAF approved methodologies used at different levels of military planning. Size of the force structure and capabilities built in this study are in accordance with RS strategic documents. The RS`s national interest is not only within its national borders but also the RS is active in the international security environment. Especially in Eastern Europe, the Near East, the Mediterranean and North Africa with a national commitment to international security the RS is politically and a military active member of the UN, EU, and NATO. Currently SAF troops are part of the UN Blue Forces in operation United Nations Interim Force in Lebanon and in the United Nations Truce Supervision Organization-Syria. The RS is a force provider to the EU Battle Group and the SAF is still a part of operation European Force-Althea in Bosnia and Herzegovina that is the EU sequence of operation Stabilization Force. In addition, to being a part of the

European Force, SAF troops are present on the coast of Somalia as part of the EU Naval Force-Somalia. However, the biggest military contribution of the SAF is to NATO led operations. Slovenia troops are in Kosovo as part of the Kosovo Force and in Afghanistan as part of the International Security Assistance Force. Slovenian contribution to the NATO Rapid Deployment capabilities is a BN size battle group in the NATO Rapid Deployment Corps-Italy. The current operational involvement represents a level of stress to the planners especially with limited strategic mobility and current budget restrictions. There is very little room for error. In the case of the SAF, this remains significant at least six years into the future but does not affect every annual budget equally. Within this budgetary environment only one or two annually budgets might be affected with munitions procurement. The reason for that is given with the relatively small size of the SAF and their munitions requirements, most of the time it is very difficult to achieve a minimum order quantity especially for certain special type of munitions.

The national defense is still the primary task of the SAF, the forces structure and capabilities are tailored to the NATO concept of collective “smart” defense where nations will contribute specific capabilities to the common pool of forces. The RS will dedicate 50 percent of their troops as part of deployable force, ready to support international efforts to establish peace and order. The rest of the SAF active and reserve forces will be primarily devoted to the national defense. Part of the commitment of the RS is that 10 percent of the SAF forces will be constantly deployed to support coalition operations.

To conduct all these military operations all around the world, using the right planning tools is crucial to avoid shortages and related mission failure. From the military point of view the ammunition planning will be under huge stress balancing training,

operations, national defense, and with budget limitations and the world ammunition market.

SAF strategic planners are using two primary methods to predict ammunition requirements. First is the LOE methodology, predominantly intended to calculate the small arms ammunition up to 20mm caliber. Second, is the TOM used to calculate bigger calibers or so called decisive munitions. In both cases, the mathematical model is based on the data and the principles described in NATO publications, as guidance to the nations in an effort to unify the planning procedures and to standardize the logistic capabilities of the deploying troops in NATO led operations. Moreover, research of SAF past strategic ammunition planning, points out that in most cases the strategic planners are using the LOE methodology as the main planning tool, combined with military professional judgment and experience, in order to finalize the six year planning cycle. With SAF LOE methodology, the planners are trying to mathematically evaluate and forecast most of the future events from strategic defense, reserves, training, and operational requirements of future military operations.

The SAF Force Command predominantly uses LOE methodology with an estimated number of weapon systems engaged in an estimated future battlefield, conducting one of the tactical tasks. Planning factors and the consumption rates are determined by SAF historical data published as the criteria for logistic operational planning. In some limited cases, the national planning factors are overridden with the NATO SDOS specially designed for specific battlefields. Tactical planners are using the same LOE methodology, with the same planning consideration, with only one difference; additional to the sustainment munitions they add BL for each weapon system. The final

amount of requested munitions to conduct an operation consists of BL for the individual weapon system plus sustainment for the duration of operation.

Training ammunition requirements on a strategic level are planned by LOE methodology, as described in the SAF strategic ammunition planning guidance's. Research shows that the operational level planning is using SAF Training Gunnery programs as the main planning tool, where the amount of ammunition is defied for all groups of SAF units and their training requirements, in accordance to the phase of the training.

The RS strategic documents were used in this study to describe the future military involvements that influence the operations, training, and national defense ammunition planning. For the synchronization analysis, strategic planning results are compared by operational/tactical SAF planning results. Table 7, displays the results of calculations using the Strategic LOE methodology, for a list of small arms munitions typically used in Infantry units. The figures consider the amount of troops, in accordance to International Operation Strategy of the RS, which will be part of the NATO, EU, UN, or other alliance operations. The figure representing one DOS is equivalent to munitions to sustain one day of operation.

The analysis of the results indicate more munitions are planned for operations on the strategic level in comparison to the operational, on average the strategic list of munitions approximates twice the amount estimated with the operational/tactical SAF methodology as shown in last column of table 7.

Table 7. SAF Operational Ammunition Forecasting			
Type of ammunition	Strategic DOS (rounds)	Operational DOS (rounds)	Strategic vs. Operational Planning
CTG 9x19 mm, ball	23.490	9.135	257%
CTG 5,56x45mm, ball	540.540	306.735	176%
CTG 5,56x45mm, ball	178.200	78.300	228%
CTG 7,62x51mm, ball	121.500	46.170	263%
CTG 8.6x70mm, ball	4.275	1.924	222%
CTG 12.7x99mm, ball	3.825	1.530	250%
CTG 7.62x51, ball	450	180	250%
CTG 40x46, HE	2.700	990	273%
CTG 81 mm, HE	2.160	1.050	206%
CTG 120 mm, HE	1.800	906	199%
MR/LR dual	270	81	333%
CTG 40x53, HEDP	30.240	13.939	217%
CTG 12,7x99 mm, 4xB+1xT	129.600	58.320	222%

Source: Created by author.

Table 8. Republic of Slovenia (RS) National Defense			
	Strategic DOS (rounds)	Operational DOS (rounds)	Strategic vs. Operational Planning
CTG 9x19 mm, ball	185.940	144.620	129%
CTG 5.56x45mm, ball	4.136.265	4.694.333	88%
CTG 5.56x45mm, ball	1.138.500	1.000.500	114%
CTG 7.62x51mm, ball	807.750	613.890	132%
CTG 8.6x70mm, ball	17.775	15.998	111%
CTG 12.7x99mm, ball	7.200	5.760	125%
CTG 7.62x51, ball	3.825	3.060	125%
CTG 40x46, HE	16.200	11.880	136%
CTG 81 mm, HE	12.960	12.600	103%
CTG 120 mm, HE	10.800	10.872	99%
MR/LR dual	720	432	167%
CTG 40x53, HEDP	181.440	167.265	108%
CTG 12.7x99 mm, 4xB+1xT	831.600	748.440	111%

Source: Created by author.

The primary task of the SAF is national defense and the analysis in table 8 illustrates that on average, 99 percent of munitions forecasted for national defense should be available, when using the Strategic munitions planning method.

Table 9. SAF Training Ammunition Forecasting

	Strategic (rounds/year)	SAF Gunnery Program (rounds/year)	Strategic vs. SAF Gunnery Program requirement
CTG 9x19 mm, ball	45.150	1.042.308	4%
CTG 5.56x45mm, ball	1.019.970	10.018.926	10%
CTG 5.56x45mm, ball	306.240	1.016.234	30%
CTG 7.62x51mm, ball	213.000	394.284	54%
CTG 8.6x70mm, ball	6.075	88.215	7%
CTG 12.7x99mm, ball	4.275	43.185	10%
CTG 7.62x51, ball	900	17.310	5%
CTG 40x46, HE	4.500	41.760	11%
CTG 81 mm, HE	3.600	7.920	45%
CTG 120 mm, HE	3.000	6.336	47%
MR/LR dual	330	204	162%
CTG 40x53, HEDP	50.400	261.419	19%
CTG12 7x99 mm, 4xB+1xT	223.200	81.744	273%

Source: Created by author.

Table 9 shows analysis of the training ammunition forecasting using the Strategic planning tools, in comparison to the SAF Gunnery Program. The results show distinct discrepancies between the two methodologies, which indicates that on average only 14 percent of the training ammunition requirement is planned with the Strategic planning methodology. The LOE methodology used in Strategic planning, on average, forecasts less munitions than is in reality, required per year, in order to fulfill all training requirements. In order to mitigate shortages, munitions are usually cross distributed from

operation and national defense to training stocks. As a second order effect, poor planning data also influences long term munitions budget forecasting.

The worst-case scenario with all SAF engaged in military operations the munitions analysis in table 10 indicates that the Strategic forecasting, meet on average, only 49 percent of the total SAF annual ammunition requirements.

Table 10. SAF "Worst-Case" Munitions Analysis

	Strategic DOS (rounds)	Operational DOS (rounds)	Strategic vs. Operational planning
Training	1.880.640	13.019.845	14%
Operations	1.039.050	519.260	200%
National Defense	7.350.975	7.429.649	99%
Total SAF	10.270.665	20.968.753	49%

Source: Created by author.

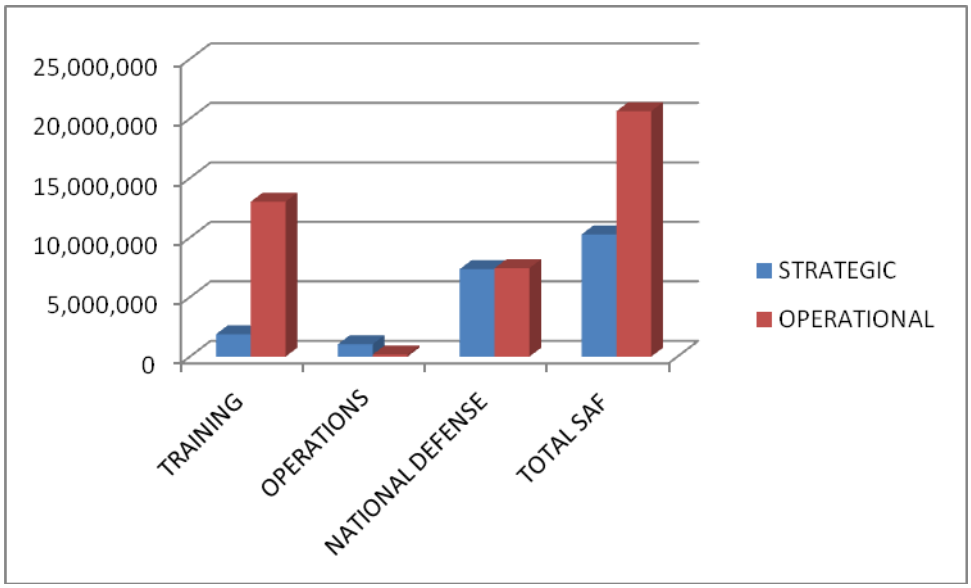

Figure 6. SAF Munitions Analysis

Source: Created by author.

Analysis of the single line results in all research categories: the SAF operational ammunition forecasting (table 7), RS national defense (table 8) and SAF training ammunition forecasting (table 9) shows very scattered results of ration between Strategic and Operational planning. With the current SAF planning factors, the results vary as much as 88 percent low and 136 percent high in the case of national defense planning; a similar pattern can be observed in operational and training planning. Table 11 shows results for each line when using a specific consumption rate for each planning level in comparison to the unified consumption rate. The planning results, with a unified consumption rate are in most lines equal.

Table 11. Single Line Unified Consumption Rate Analysis

	National Defense (ration between Strategic vs. Operational planning)	
Type of ammunition	Specific Consumption Rate	Unified Consumption Rate
CTG 9x19 mm, ball	129%	120%
CTG, 5,56x45mm, ball	88%	120%
CTG 5,56x45mm, ball	114%	120%
CTG 7,62x51mm, ball	132%	120%
CTG 8.6x70mm, ball	111%	120%
CTG 12.7x99mm, ball	125%	120%
CTG 7.62x51, ball	125%	120%
CTG 40x46, HE	136%	176%
CTG 81 mm, HE	103%	120%
CTG 120 mm, HE	99%	124%
MR/LR dual	167%	231%
CTG 40x53,HEDP	108%	120%
CTG 12,7x99 mm, 4xB+1xT	111%	120%

Source: Created by author.

Additional analysis of how unified consumption rates influence overall munitions forecasting accuracy is presented in table 12. The first line presents the average planning accuracy, when each panning level is using specific consumption rates matching the distinct planning level. The second line presents results when strategic consumption rates are used in all planning levels as unified consumption rates. The last two lines present; when tactical consumption rates are used as unified planning factors. The optimal forecasting would present 100 percent with no excess ammunitions.

Table 12. Unified Consumption Rate Analysis

Planning Factors	Planning Accuracy
Deferent across the levels*	110%
SAF strategic planning factors	135%
Battalion/Brigade size unit planning factors	227%
Company size unit planning factors	283%

Source: Created by author
*Specific planning factors for each level, determined by specific consumption rates.

When the strategic consumption rates are used across all planning levels, the difference grows to 35 percent over the optimal forecasting. The tactical consumption rates as unified planning factors, results in two to three times more munitions planned as would be needed.

The alternative planning methodologies used in NATO, which as an organization is trying to unify not only equipment interoperability but also procedure, terms, and methodologies used in planning, as well as providing the tools to do so. NATO as an organization does not currently dictate to the nations what equipment to buy or use, as

long as the existing equipment is interoperable with any other NATO nation. The same goes with the planning methodologies, the main goal is to determine the common understanding of terms, procedures, and methodologies. The final planning product should be more or less the same.

First, nations agree on the common planning principles that each nation is primarily responsible for equipping, training, and sustaining their own troops as part of the NATO forces. Second, the nations can use the NATO developed guidance for logistics requirements that are developed with the statistical evaluation of the consumption rate from different battlefields where NATO forces were involved. The data can give the individual nations a forecast of estimated consumptions rates of certain commodities, dependent on the type of operations per number of troops. Finally, is the development of the Stockpile Planning Guidance, which is developed during the Defense Planning Process by the NATO Commanders and can be aligned to a specific operation. Before the guidance is issued to the nations, the SPG is confirmed by the nations in the planning committee.

The SPG is sent to the nations where they can use it as part of their national planning method or can use the NATO developed ammunition planning applications called ACROSS. ACROSS uses primarily two different methodologies TOM to calculate decisive ammunition in calibers equal or bigger than 20 mm and LOE methodology which in order to calculate the small arms ammunition smaller than 20 mm. ACROSS uses data from other NATO planning tools such as Logistics Functional Services, Allied Deployment and Movement System, Logistic Reporting Tool and others: the common database is shared among different applications. The ACROSS LOE methodology

calculates the ammunition requirement considering average consumption per day, combat intensity, and the number of consumers. The most important piece of data in the calculation is ammunition consumption rate that is based on the average consumption rate for defense, attack, and delay. The consumption rate is attached for each weapon system with the specific NATO identification code, which describes the interoperable weapon systems and not necessarily a single weapon system, therefore the same ammunition can be used for the same group of weapon systems. It is the case with ammunition identification codes, where nations are providing ammunition data that satisfy interchangeability criteria of form, fit, and function only. The most important fact is that the NATO data and guidance are accessible to the NATO nations through a secret network Crisis Response Operations in NATO Operating Systems because most of the information has restrictions. Planning tools are accessible to NATO nations and with some restrictions to most in Partnership for Peace, the Mediterranean initiative, and other organizations. ACROSS applications, as well as the Logistics Functional Services family, are available to all with the upgrades and training.

A majority of the NATO countries are trying to find the perfect formula for ammunition planning in order to reduce costs and inventory but at the same time have enough munitions to support operations. Most of these countries are using more or less NATO SPG, with the LOE and TOM.

There is no precise conclusion as to what type of methodology is most widely used among countries. Most European countries and Canada are using NATO SPG as a base for ammunition planning and ACROSS as planning reference. However, there is not a clear line between LOE used only for small arms and TOM for bigger calibers and

decisive munitions. Each methodology has its forecasting strengths and limitations; therefore, it leads nations to adopt known methodologies and customize them in order to meet their strategic guidance. For example, Canadian forces are using SPG with TOM for decisive munitions and LOE for small arms, British forces are not tied to any specific methodology but are using NATO SPG and only LOE methodology to support planning processes and employing professional judgment to finalize the forecasting if necessary, with modeling and historical data.

US Armed Forces are using TOM and LOE methodology with variations for the specific Service, predominantly TOM with theater simulations. The USMC is using LOE methodology and in order to mitigate the limitations of the method they developed two separated models; LOE–Shooter Oriented and LOE–Target Oriented. The basic difference between these two methodologies is; the first is oriented to the amount of munitions depending on the number of troops and the second method is focused more on how many targets need to be destroyed.

From all the examples identified in this thesis, the author concludes that all nations are using the same methodologies as the SAF. However, there is national preference in the final execution depending on experience of the area, available historical data, usage of national or NATO tools, or restrictions and limitations that push nations to improve their planning tools and techniques.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

> You don't kill men with guns you're not using.
>
> — Gen Matthew B. Ridgway, USA,
> *Quotes for the Air Force Logistician*

Conclusions

Is current SAF ammunition forecasting methodology capable to support future operational challenges? The answer to the primary question is no.

This study reveals that the current SAF ammunition forecasting methodology has certain limitations to support future operations, in accordance with the RS National Defense and Security Strategy. The ammunition forecasting results in this study show that using current forecasting methodology for operations, compared to strategic forecasting, results in approximately twice the needed amount of munitions (table 7). Strategic planning forecasts 99 percent of all needed munitions, slightly below the estimated requirements to support the national defense (table 8). In the case of the training munitions, the planning results are even poorer. Allocating only 14 percent of the required ammunition needed to execute all planned training, when using the LOE planning methodology to plan training munitions. Using the LOE methodology as the method to plan training ammunition is obviously not the right solution. The LOE methodology used in Strategic planning, on average, forecasts less munitions than is in reality, required per year, in order to fulfill all training requirements. In order to mitigate shortages, munitions are usually cross distributed from operation and national defense to training stocks. As indicated in table 9 the LOE methodology does not forecast adequate

training ammunition. Therefore, the forecasting solution presents itself, the training munitions requirement should only use the SAF Gunnery Training Program, in synchronization with the SAF Training Cycle and the planning of the training munitions should be done separate from the strategic operational forecasting.

The worst-case scenario with all SAF engaged in military operations munitions analysis, in table 10, indicates that the Strategic forecasting meets on average, only 49 percent of the total SAF annual ammunition requirements. With two year munitions stocks adjustments, long procurement procedures, and “minimum order quantities” it does not favor the “just in time” principle, especially considering sustaining national defense capabilities. This is another indication in support of the statement that current methodology does not support future operations. Strategic forecasting should predict enough munitions in order to support the training, operational, and national defense requirement. However, as indicated in the research with the current SAF strategic planning methodology, less than 50 percent of munitions requirements are forecasted.

Even though the SAF are using the same planning methodology, the basic planning factor SDOS is changing for each planning level from tactical, operational, to strategic. Continued analysis of planning factors and data comparisons (table 11) demonstrate several distinct differences between planning levels. When evaluating the average result (table 12) optimized forecasting is achieved when using consumption rates, distinct for each planning level. However, with single line planning analysis, it can be observed, scattered results of ration between strategic and operational planning. With the current SAF planning factors, the results vary as much as 88 percent low and 136 percent high in the case of national defense planning. Using unified planning factors across the

planning levels improves single line results (table 11) all results are above 100 percent which indicate more than enough munitions is forecasted. With strategic consumption rates used across all planning levels, the average difference grows up to 35 percent over the optimal forecasting. However, it supports adequate single line planning and overall forecasting. Therefore, NATO SPG (SAF strategic planning factors) consumption rate should be used as the unified consumption planning factor. The final munitions forecasting will be adequate, which according to analysis in table 12 is more than the minimal annual requirement that is also confirmed by average and single line analysis. To improve and maintain planning accuracy, planning data should be constantly evaluated and updated. The second and third order effect on developing and sustaining national planning factors involves huge amounts of working hours, dedicated to historical data analysis with future battlefields modeling. Therefore, for SAF the best solution would be using the NATO SPG. NATO poses huge databases of historical data that is constantly updated and available to the work force, to conduct all necessary analysis and computer modeling in order to make planning factors optimal.

As stated in the SAF Guidance for Ammunition Planning: since 2006 the NATO program ACROSS should have been implemented in the SAF as a main ammunition planning tool, but in reality, ACROSS is not used as the main SAF ammunition planning tool. Appropriate national defense and operational requirement forecasting for small arms munitions can use the LOE methodology. With continued development and improvement of the planning factors and implementing NATO ACROSS as the primary planning tool, forecasting accuracy could be upgraded.

Recommendations

The conclusions of the research leads to a new area; recommendations for future study and some conclusions lead directly to recommendations concerning some fields of study.

1. A recommendation for future studies is to conduct planning methodology evaluations for decisive munitions.
2. As already expressed in the conclusions, separate planning of training and operational ammunition. Required amount of training ammunition should be calculated using the SAF Gunnery Training Program where amount and type of ammunition is clearly stated for each type of the units combat arms, support, and reserve units and the annual SAF training plan. Resolution on General Long-Term Development and Equipping of the SAF and the National Security Strategy of the RS declare total numbers of the size and types of SAF units up to year 2025, which gives logistics planners the required data to plan training ammunition.
3. Study the training program itself and if needed, revise the training program, especially revising cost effectiveness of live fire training, compared to using training simulators.
4. Consider using unified ammunition consumption rate SDOS. NATO SPG SDOS should be considered as a universal planning factor for all planners, which will also simplify planning for NATO led operations where capability statements should be presented to the NATO Commander SAF before Transfer of Authority.

5. My final recommendation to SAF is to adopt NATO ACROSS as the national planning tool, especially since the SAF is already using the Logistics Functional Services, Logistic Reporting Tool, and the Allied Deployment and Movement System as planning and reporting tools. These will simplify the ammunition planning process across operational and strategic requirements as all NATO planning guidance has factors, depending on the geographical location of the operation, and operational conditions will update automatically when using the ACROSS planning tool.

APPENDIX A

MATHEMATICAL FORMULAS AND CALCULATIONS

SAF LOE Methodology

Safety Stocks Calculated by the LOE Methodology:

$$Z_V = M^* Q_{SDOS} * Q_{OR.OB} + \sum L_i * Q_{SDOS} * Q^i_{OR\ DE.} + \sum N_i * Q_{SDOS} * Q_{OR.DE} + \sum N_k * Q_{SDOS} * Q_{OR.UP}$$

1. Level of the Strategic reserves:

$$I = M * Q_{SDOS} * Q_{OR.OB}$$

M - sustainment factor; $M \geq 15$

Q_{SDOS} - average estimated ammunition quantity used in operation time dependent

$Q_{OR.OB}$ - quantity of weapons total

2. Average consumption during combat

$$II = \sum L_i * Q_{SDOS} * Q^i_{OR\ DE.}$$

L_i – combat intensity; $L \geq 30$

$Q_{OR.DE}$ –quantity of weapons used in operation

3. Training requirements

$$III = \sum N_i * Q_{SDOS} * Q_{OR.DE}$$

N_i - yearly training factor; $N \geq 4$ for calibers $\leq$ 20mm, $N \geq 2$ for $\geq$20mm

$Q_{OR.DE}$ –quantity of weapons used in operations / training

4. Training munitions related to training intensity

$$IV = \sum N_k * Q_{SDOS} * Q_{OR.UP}$$

N_k - yearly training factor; $N \geq 4$ for calibers $\leq$ 20mm, $N \geq 2$ for $\geq$20mm

$Q_{OR.UP}$ - quantity of weapons in service

Maximal Stocks

$$Z_{max} \leq \sum L_i * Q_{SDOS} * Q_{OR.DE} + \sum N_i * Q_{SDOS} * Q_{OR.DE} + \sum N_k * Q_{SDOS} * Q_{OR.UP} + t_{zd}$$

t_{zd} – ammunition life time (shelf time)

Signal Stocks

$$Zs = M * Q_{SDOS} * Q_{OR.OB} + \sum Li * Q_{SDOS} * Q_{OR.DE} + \sum N_i * Q_{SDOS} * Q_{OR.DE} * tdob + \sum N_k * Q_{SDOS} * Q_{OR.UP} * t\ dob$$

Planning Categories

$$Za = Z - Zv$$

$$Zop = Z - Zs$$

$$Q\ dob = Zmax - Zv$$

Z - current amount of ammunition in stocks

SAF TOM Methodology

$$Z_V = M^* Q_{SDOS} * Q_{OR.OB} + \sum L_i * Q_{SDOS} * Q^i_{OR\ DE.} + \sum \mathbf{Q_{JTOM}} + \sum N_i * Q_{SDOS} * Q_{OR.DE} + \sum N_k * Q_{SDOS} * Q_{OR.UP}$$

$$Zs = M^* Q_{SDOS} * Q_{OR.OB} + \sum Li * Q_{SDOS} * Q_{OR.DE} + \sum \mathbf{Q_{JTOM}} + \sum N_i * Q_{SDOS} * Q_{OR.DE} * tdob + \sum N_k * Q_{SDOS} * Q_{OR.UP} * t\ dob$$

$$Z_{max} \leq \sum L_i * Q_{SDOS} * Q_{OR.DE} + \sum \mathbf{Q_{JTOM}} + \sum N_i * Q_{SDOS} * Q_{OR.DE} + \sum N_k * Q_{SDOS} * Q_{OR.UP} + t_{zd}$$

Q_{JTOM} – ammunition quantity needed in order to destroy the enemy target with 95 percent probability

The distinct difference in SAF TOM methodology comparing to the LOE is the sections where amount of decisive ammunition is added for each operation where enemy targets can be destroyed with 95 percent probability.

SAF Operational Planning

WS x SDOS=DOS

WS x SDOS x CMF=CDOS

WS—weapon system

CMF—combat modification factor

DOS—days of supply

CDOS—combat days of supply

SAF Tactical Planning

On the tactical level planning for each weapon system the basic load and the Combat Day of Supplies presents the base pack for the planer. The DOS data is same as on the operational data calculation is the same with only difference with adding the amount of ammunition for the BL.

∑BL * WS + ∑WS* DOS*CMF = Total amount of ammunition that unit is deploying with.

BL – basic load

WS – weapon systems

SDOS - standard days of supply

CMF – combat modification factor

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